

**Brush Creek and Crooked Creek *E. coli* TMDL REVISION**  
**Rockcastle County, Kentucky**  
**TMDL ID# 31595**  
**January 24, 2012**

**Note: This revision addresses Crooked Creek and the Unnamed Tributary (UT) to Crooked Creek only and will not affect Brush Creek.**

**A. TMDL Background:**

The Brush Creek and Crooked Creek *E. coli* TMDLs (“the TMDL”) were originally approved on November 29, 2006. At the time the TMDL was finalized, the document addressed the 303(d) listed segment of Crooked Creek (GNIS ID: 511648\_00) from RM 1.0 to 6.4 and Brush Creek (GNIS ID: 510966\_00) from RM 1.1 to 7.5, which were impaired for pathogens for the Primary Contact Recreation (PCR) Use. For this TMDL, the loading capacities for Brush and Crooked Creeks were determined by load duration curve (LDC) analyses, which show the allowable loads at a given flow duration interval. Monitoring data are expressed as loads and plotted on the LDC at the duration interval corresponding to the measured flow. The critical conditions for these TMDLs (defined as a flow condition) were determined for each sampling site from monitoring data and were selected based on the magnitude and frequency of observed exceedances from the Water Quality Criterion (WQC) for *E. coli*. The required reductions necessary to achieve the allowable loads are calculated using the critical condition and the allowable load at the corresponding flow duration interval.

In addition to allocations for Brush Creek (not included here), the TMDL document provided TMDL, WLA and LA values for four monitoring sites on Crooked Creek and one site on a UT to Crooked Creek, shown below:

**Table 1 Original TMDL Allocations**

Site Name	Critical Flow Condition	Existing Load (BoC/day) <sup>1</sup>	TMDL Target Load (BoC/day) <sub>1</sub>	WLA		LA		MOS	
				(BoC/day) <sub>1</sub>	% Reduction	(BoC/day) <sub>1</sub>	% Reduction	(BoC/day) <sub>1</sub>	% of TMDL
<b>TMDL01CC</b> Lower Crooked Cr.	36.5%	416.31	41.62	0.00 <sup>2</sup>	0.0%	37.46	91%	4.16	10%
<b>TMDL02CC</b> Lower Middle Crooked Cr.	46.9%	75.71	19.73	0.00 <sup>2</sup>	0.0%	17.76	** <sup>3</sup>	1.97	10%
<b>TMDL03CC</b> Upper Middle Crooked Cr.	8.0%	465.17	136.81	0.00 <sup>2</sup>	0.0%	123.13	** <sup>3</sup>	13.68	10%
<b>TMDL04CC</b> Upper Crooked Cr.	51.0%	11.60	9.04	0.00 <sup>2</sup>	0.0%	8.14	** <sup>3</sup>	0.90	10%
<b>TMDL05CC</b> UT to Crooked Cr. Below TMDL02CC	38.6%	71.29	5.52	0.00 <sup>2</sup>	0.0%	4.97	93%	0.55	10%

**Notes:** 1) Billions of colonies per day  
2) Any future permitted point source must meet permit limits based on the Water Quality Standards in 401 KAR 5:031, and must not cause or contribute to an existing impairment.  
3) Less than 10% of the samples collected violated the WQC, therefore no load reduction was calculated.

### B. Purpose of Proposed Revision:

The Brush Creek and Crooked Creek *E. coli* TMDLs were finalized for Crooked Creek from RM 1.0 to 6.4 and Brush Creek from RM 1.1 to 7.5, as indicated on the 1998 to 2006 303(d) Lists. Brush Creek *E. coli* TMDLs are not being revised and will not be discussed in this Revision. As part of the 2008 303(d) List, KDOW divided Crooked Creek into two segments and indicated that the lower segment was also impaired for Siltation and Habitat Alterations (other than flow). KDOW is revising the TMDL to include the impaired segment of UT to Crooked Creek from RM 0.0 to 0.4 based on the data included in the original TMDL. Figure 1 depicts the assessed segments of Crooked Creek and proposed segment of the UT to Crooked Creek.

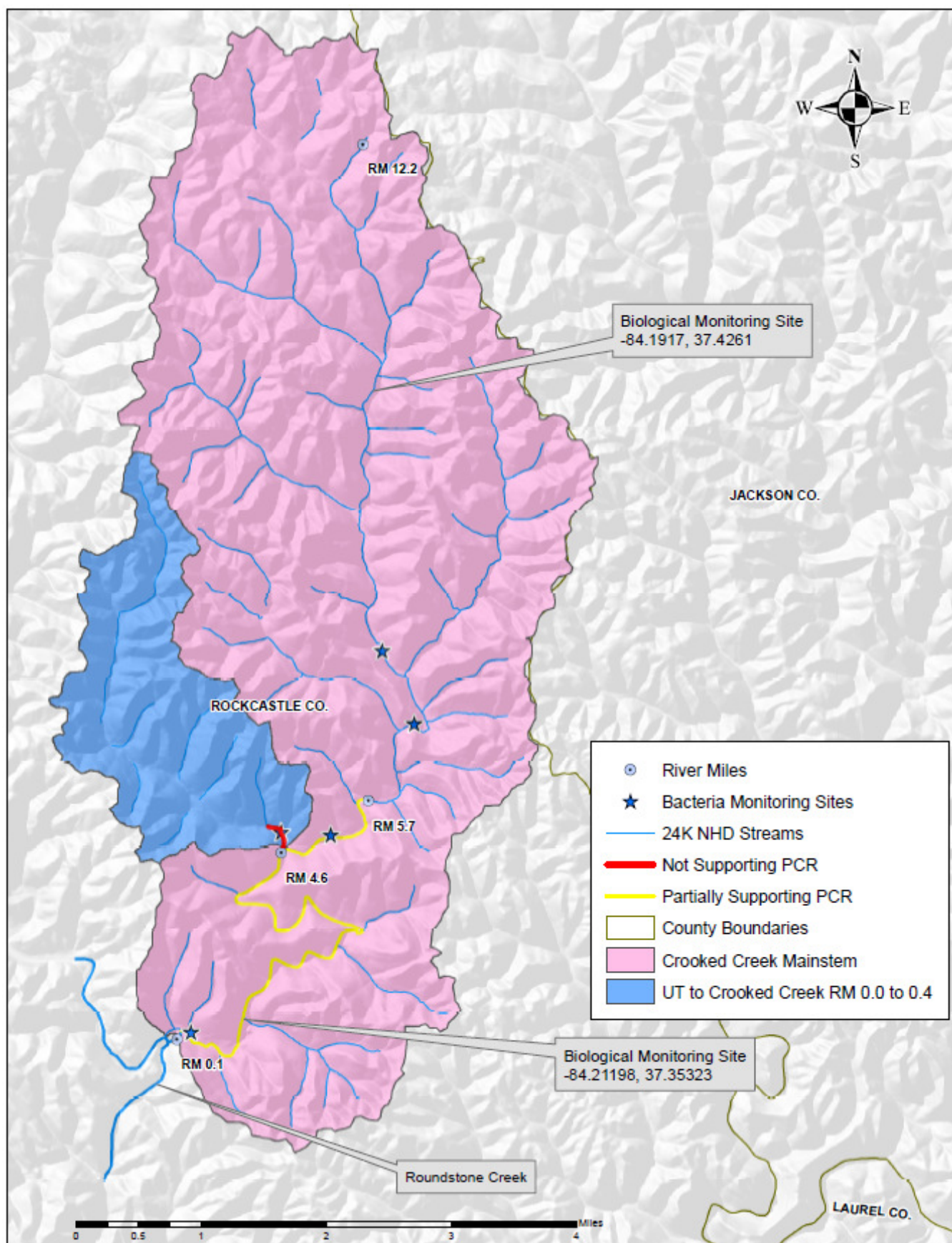
### C. Justification for Revision:

The original TMDL document provided existing and allowable loads (i.e. TMDL, WLA, LA, and MOS) at each TMDL monitoring site in the Crooked Creek watershed. At the time of TMDL development, the KDOW TMDL Section was only developing TMDLs for segments that were already assessed as impaired by a pollutant. After 2007, the KDOW TMDL Section began assessing and developing TMDLs concurrently, using the data collected as a result of the TMDL monitoring. This Revision provides a TMDL for an un-assessed UT to Crooked Creek (GNIS ID: KY511648-4.6\_00) found to be impaired for its PCR designated use as a result of the TMDL monitoring. Table 2 depicts the data collected on the UT to Crooked Creek in 2005.

The LDC method was utilized to derive the loadings at each monitoring site using an area weighting method approach from a nearby USGS gage (03406500). The LDC method is described in Section 5 of the approved document (pages 19-22). Table 3 is a copy of the summary table also provided in the original document. This table identifies the critical condition by noting the flow zone with the highest magnitude and frequency of observed exceedances from the WQC (for *E. coli*). Loadings calculated at site TMDL05CC will be used to apply the TMDL to the UT to Crooked Creek.

**Table 2 *E. coli* Data Collected from the UT to Crooked Creek**

Collection Date	<i>E. coli</i> (col per 100 ml)	Dissolved Oxygen mg/L	pH	Temperature	Specific Conductance	Flow
5/5/2005	65	11.4	7.4	11.3	87.66	4.63
5/12/2005	28	11.64	7.07	11.55	114.3	1.46
5/19/2005	12	11.06	7.44	11.72	136	1
5/24/2005	150	10.97	7.04	11.63	129.8	1.28
6/17/2005	59	11.45	7.28	12.09	209.5	0.42
6/22/2005	24	12.35	7.29	13.09	177.9	0.31
7/13/2005	2400	14.73	7.3	21.24	196.7	0.94
7/13/2005	3100 (Duplicate)					0.94
7/21/2005	369	10.72	7.24	12.72	229.8	0.38
7/27/2005	435	10.83	7.52	12.55	191.8	0.3
8/3/2005	199	8.72	7.19	15.6	272.9	0.2
9/7/2005	10	10.57	7.28	12.72	276.9	0.09
10/4/2005	4	10.85	7.8	12.51	212.1	0.092



**Figure 1 Monitoring Sites and Assessed Segments of the Crooked Creek Watershed**

**Table 3 Summary of Existing and Allowable Loads in Crooked Creek by Flow Duration Zone**

Flow Duration Zone	Existing Conditions		TMDL = WLA + LA + MOS				TMDL Target Load (BoC/Day) <sup>1</sup>	Reduction (percent)
	WLA (BoC/Day) <sup>1</sup>	LA (BoC/Day) <sup>1</sup>	TMDL (BoC/Day) <sup>1</sup>	WLA (BoC/Day) <sup>1</sup>	LA (BoC/Day) <sup>1</sup>	MOS (BoC/Day) <sup>1</sup>		
TMDL01CC Lower Crooked Creek	High	0	N/A <sup>2</sup>	5595.01	0 <sup>3</sup>	5035.51	5035.51	N/A <sup>2</sup>
	Moist	0	416.31	41.62	0 <sup>3</sup>	37.46	37.46	91%
	Mid-Range	0	144.85	33.23	0 <sup>3</sup>	29.91	29.91	79%
	Dry	0	N/A <sup>2</sup>	10.10	0 <sup>3</sup>	9.09	9.09	N/A <sup>2</sup>
	Low Flow	0	N/A <sup>2</sup>	3.01	0 <sup>3</sup>	2.71	2.71	N/A <sup>2</sup>
TMDL02CC Lower Middle Crooked Creek	High	0	N/A <sup>2</sup>	4106.43	0 <sup>3</sup>	3695.79	3695.79	N/A <sup>2</sup>
	Moist	0	N/A <sup>2</sup>	112.15	0 <sup>3</sup>	100.93	100.93	N/A <sup>2</sup>
	Mid-Range	0	75.71	19.73	0 <sup>3</sup>	17.76	17.76	**4
	Dry	0	N/A <sup>2</sup>	9.74	0 <sup>3</sup>	8.76	8.76	N/A <sup>2</sup>
	Low Flow	0	N/A <sup>2</sup>	2.21	0 <sup>3</sup>	1.99	1.99	N/A <sup>2</sup>
TMDL03CC Upper Middle Crooked Creek	High	0	465.17	136.81	0 <sup>3</sup>	123.13	123.13	**4
	Moist	0	N/A <sup>2</sup>	86.21	0 <sup>3</sup>	77.59	77.59	N/A <sup>2</sup>
	Mid-Range	0	N/A <sup>2</sup>	15.27	0 <sup>3</sup>	13.74	13.74	N/A <sup>2</sup>
	Dry	0	N/A <sup>2</sup>	7.49	0 <sup>3</sup>	6.74	6.74	N/A <sup>2</sup>
	Low Flow	0	N/A <sup>2</sup>	1.70	0 <sup>3</sup>	1.53	1.53	N/A <sup>2</sup>
TMDL04CC Upper Crooked Creek	High	0	N/A <sup>2</sup>	2207.21	0 <sup>3</sup>	1986.49	1986.49	N/A <sup>2</sup>
	Moist	0	N/A <sup>2</sup>	60.28	0 <sup>3</sup>	54.25	54.25	N/A <sup>2</sup>
	Mid-Range	0	11.60	9.04	0 <sup>3</sup>	8.14	8.14	**4
	Dry	0	N/A <sup>2</sup>	5.23	0 <sup>3</sup>	4.71	4.71	N/A <sup>2</sup>
	Low Flow	0	N/A <sup>2</sup>	1.19	0 <sup>3</sup>	1.07	1.07	N/A <sup>2</sup>
TMDL05CC UT to Crooked Creek	High	0	N/A <sup>2</sup>	813.59	0 <sup>3</sup>	732.23	732.23	N/A <sup>2</sup>
	Moist	0	71.29	5.52	0 <sup>3</sup>	4.97	4.97	93%
	Mid-Range	0	3.30	2.23	0 <sup>3</sup>	2.01	2.01	42%
	Dry	0	3.19	1.76	0 <sup>3</sup>	1.58	1.58	50%
	Low Flow	0	N/A <sup>2</sup>	0.44	0 <sup>3</sup>	0.39	0.39	N/A <sup>2</sup>

- Notes:
1. BoC/Day = Billions of Coliforms E. coli per day
  2. N/A = No sample collected in this flow zone exceeds the Water Quality Criterion. Therefore the percent reduction is unknown
  3. Any future permitted point source must meet permit limits based on the Water Quality Standards in 401 KAR 5:031, and must not cause or contribute to an existing impairment
  4. Less than 10% of the samples collected violated the WQC, therefore no load reduction was calculated.
  5. The critical flow condition is highlighted

#### D. Revised TMDL Allocations:

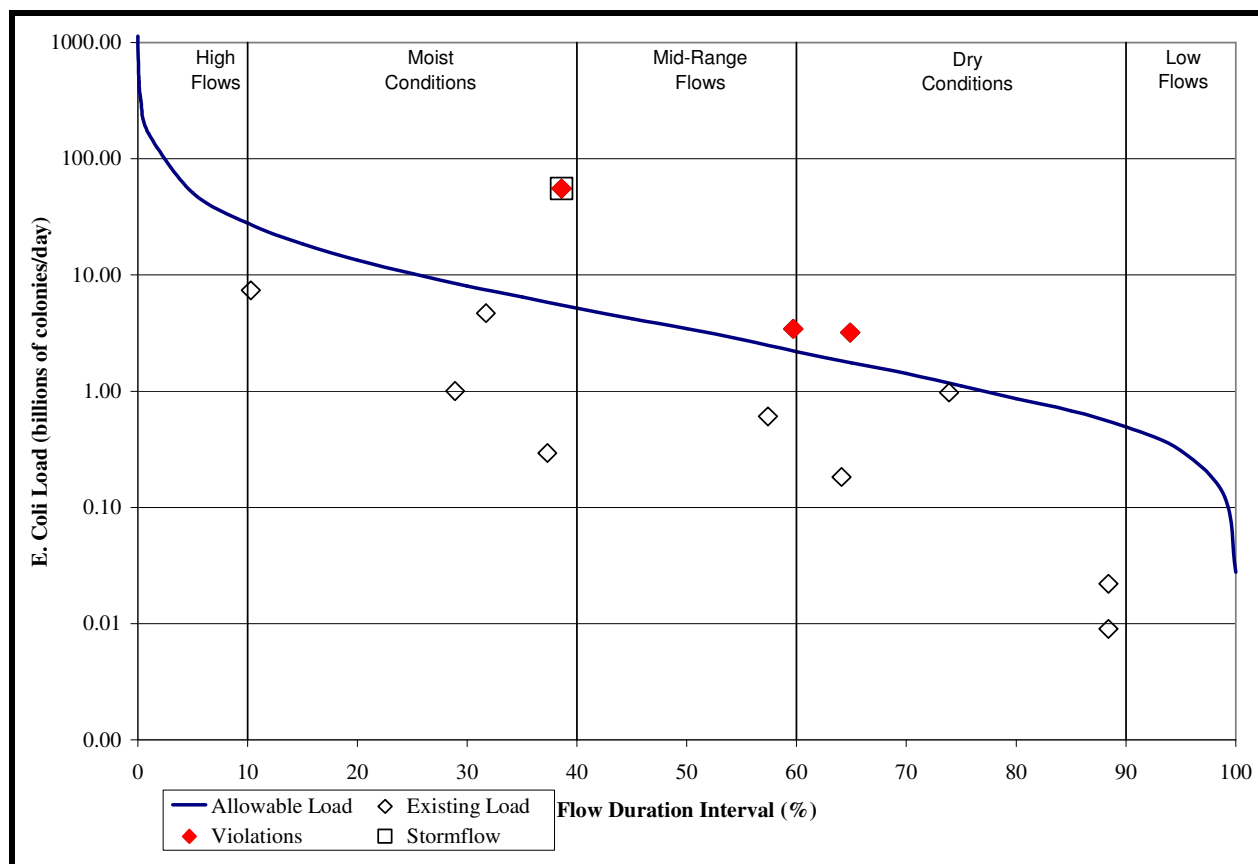
The Brush Creek and Crooked Creek *E. coli* TMDL document provided adequate data and information to calculate TMDL, WLA and LA values for the UT to Crooked Creek; in addition, no new monitoring has taken place in the Crooked Creek watershed since TMDL development. Therefore, revised or new TMDL allocations are not necessary. Table 3 depicts the TMDL and allocations included in the original TMDL document for the UT to Crooked Creek (GNIS ID: KY511648-4.6\_00). Figure 2 shows the LDC illustrating the TMDL in relation to the flow duration intervals and bacteria sample results.

**Table 3 TMDL and Allocations for the UT to Crooked Creek, Site TMDL05CC**

Site Name	Critical Flow Condition	Existing Load (BoC/day) <sup>1</sup>	TMDL Target Load (BoC/day) <sub>1</sub>	WLA		LA		MOS	
				(BoC/day) <sub>1</sub>	% Reduction	(BoC/day) <sub>1</sub>	% Reduction	(BoC/day) <sub>1</sub>	% of TMDL
<b>TMDL05CC</b> UT to Crooked Cr. Below TMDL02CC	38.6%	71.29	5.52	0.00 <sup>2</sup>	0.0%	4.97	93%	0.55	10%

**Notes:**

- 1) Billions of colonies per day
- 2) Any future permitted point source must meet permit limits based on the Water Quality Standards in 401 KAR 5:031, and must not cause or contribute to an existing impairment.
- 3) Less than 10% of the samples collected violated the WQC, therefore no load reduction was calculated.



**Figure 2 Load Duration Curve and TMDL for the UT to Crooked Creek, Site TMDL05CC**

#### **E. Other Considerations**

The Brush Creek and Crooked Creek *E. coli* TMDL document was developed with consideration given to the entire watershed. Although the intent of this Revision is to document allocations for each of the segments of Crooked Creek and its tributaries, implementation efforts should remain consistent with the spirit of the watershed approach. The 'Implementation' section of the document (page 28) describes the approaches recommended by KDOW to address water quality issues in the watershed including current and planned projects.

#### **F. Public Participation:**

The Brush Creek and Crooked Creek *E. coli* TMDLs were placed on Public Notice on August 17, 2006. Because the UT to Crooked Creek was never assessed and has never appeared in the Integrated Report, this TMDL Revision was published for a 33-day public notice period. A public notice was sent to all newspapers in the Commonwealth of Kentucky and an advertisement purchased in the newspaper of highest circulation (the Mount Vernon Signal). Additionally, the public notice will be distributed electronically through the 'Press Release' mailing list maintained by the Governor's Office of media outlets across the Commonwealth.

No comments were received during the public notice period.